Each question is a multiple choice question with two answer choices: True (**T**) and False (**F**).

- Mark only one field per question.
- Mark the field of choice like this: ☒
- If you mark the wrong field, fill it completely: ■
  Then mark the correct field like this: ☒
- For a correct answer, you will receive 1 point.
- For an incorrect answer, you will receive −1 points.
- For no answer or unclear answer given, you will receive 0 points.

1 Probability Theory

Consider the following (joint) probabilities for the random variables X and Y:

- $\mathrm{P}(X = 0 \cap Y = 0) = a$
- $\mathrm{P}(X = 0 \cap Y = 1) = \frac{1}{10}$
- $\mathrm{P}(X = 1 \cap Y = 0) = \frac{2}{5}$
- $\mathrm{P}(X = 1 \cap Y = 1) = b$

T **F**

☐ ☐ Let $a = \frac{1}{10}$ and $b = \frac{2}{5}$. It then holds that $X \perp\!\!\!\perp Y$.

☐ ☐ $X \perp\!\!\!\perp Y \; \forall a, b \in \{\frac{2}{5}, \frac{1}{10}\}$.

☐ ☐ $\mathrm{E}(X) = \frac{2}{5}b$.

☐ ☐ $\mathrm{Var}(X) = b^2 + \frac{2}{5}b^2 + \frac{4}{25}$.

☐ ☐ $\mathrm{P}(X = 0|Y = 1) = \frac{2/5}{1/10+b}$.

2 Cumulated Distribution Function (CDF)

T **F**

☐ ☐ $F(x) = \begin{cases} 0 & , x < 5 \\ \frac{1}{3} & , 5 \leq x < 7 \\ a & , x \geq 7 \end{cases}$ is a valid CDF if $a \leq 1$

☐ ☐ $F(x) = \begin{cases} 0 & , x < 0 \\ x^a & , 0 \leq x \leq 1 \\ a, 1 & x > 1 \end{cases}$ is a valid CDF if $a \in \mathbb{R} \backslash \{0\}$.

☐ ☐ Despite your answer, consider that the CDF above is a valid one. It then holds that $\mathrm{P}(X \leq 1) = 1$

☐ ☐ Despite your answer, consider that the CDF above is a valid one. It then holds that $\mathrm{P}(\frac{1}{2} < X \leq 2) = 1 - x^a$

☐ ☐ Despite your answer, consider that the CDF above is a valid one. It then holds that $\mathrm{P}(X > \frac{1}{4}) = x^a$

3 Probability Mass Function (pmf) and Probability Density Function (pdf)

T F

☐ ☐ Consider the plotted pmf in Figure 1. The corresponding pmf is given by

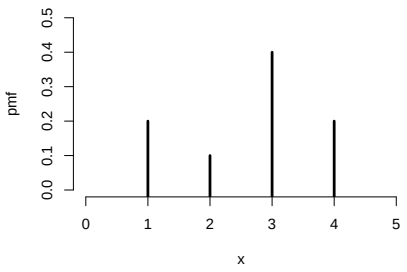

Figure 1: Probability Mass Function

$$f(x) = \begin{cases} 0.2 & , x = 1 \\ 0.1 & , x = 2 \\ 0.4 & , x = 3 \\ 0.3 & , x = 4 \end{cases} .$$

☐ ☐ $\mathrm{P}(X \leq 3) = 0.4$

☐ ☐ Consider the plotted pdf in Figure 2. It holds that $\mathrm{P}(X \leq \frac{1}{2}) = 1$

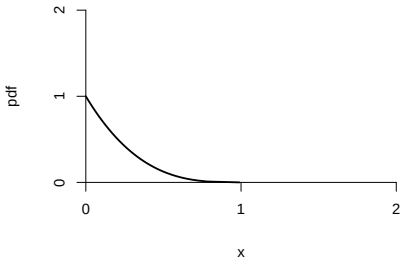

Figure 2: Probability Density Function

☐ ☐ $\mathrm{P}(X = 0) = 1$